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Discovery of '*Acrocercops*' *tricuneatella* (Gracillariidae, Gracillariinae) from Ryûkyû, southern Japan, and its appropriate generic placement

Kazuhiro SUGISIMA[1], Tosio KUMATA[2] and Satoru TOMINAGA[3]

[1] Laboratory of Systematic Entomology, Faculty of Agriculture, Hokkaido University, Sapporo, 060-8589 Japan
[2] Bunkyôdai-minamimati 45-16, Ebetu, Hokkaidô, 069-0835 Japan
[3] Kochinda 251-3, Kochinda-chô, Okinawa-ken, 901-0401 Japan

Abstract *Gibbovalva tricuneatella* (Meyrick, 1880), comb. nov., which has been referred to the genus *Acrocercops* Wallengren, 1881 for a long time, is redescribed on specimens reared from leaf-mines on *Typha domingensis* (Typhaceae) at Okinawa-hontô, Ryûkyû, southern Japan. The wing venation and genitalia of both sexes are illustrated for the first time. Biological notes are given on observations at Okinawa-hontô. The species is transferred to the genus *Gibbovalva* Kumata & Kuroko, 1988 mainly on the structures of the male genitalia.

Key words The *Acrocercops*-group, hump of valva, comb of valva, anellus, Australia.

The Gracillariidae is known as the largest family of leaf-miners with the widest diversity of foodplants used (Powell, 1980). Nevertheless, only a very small number of gracillariid species have been reported to feed on the monocotyledons in the larval stage (Robinson *et al.*, 2005). One such exceptional gracillariid is *Acrocercops tricuneatella* (Meyrick, 1880) belonging to the subfamily Gracillariinae. This species was described from New South Wales, Australia as a leaf-miner on *Typha latifolia* L. (Typhaceae) (Meyrick, 1880), and it is currently known as the leaf-miner on *T. angustifolia* L. (Typhaceae) in a wide area of southern Queensland and New South Wales, Australia (Common, 1990).

Recently, moths of a gracillariid species were reared from leaf-mines on *Typha domingensis* Pers. (Typhaceae) at Kan'na-dam, Okinawa-hontô, Ryûkyû, southern Japan by the third author. The moths were identified as *Ac. tricuneatella* by the first and second authors. In addition, these two authors found that the male genitalia of the species have autapomorphies not of *Acrocercops* Wallengren, 1881 but of *Gibbovalva* Kumata & Kuroko, 1988.

In this paper, on the basis of specimens from Ryûkyû, *Ac. tricuneatella* is transferred to *Gibbovalva* and redescribed with biological notes. Systematic statements are given by the first and second authors; biological statements are based on observations by the third author.

Gibbovalva tricuneatella (Meyrick) (Figs 1–19), **comb. nov.**

Gracilaria [!] *tricuneatella* Meyrick, 1880, *Proc. Linn. Soc. N. S. W.* **5**: 146.
Acrocercops tricuneatella: Meyrick, 1912, *in* Wagner, *Lepid. Cat.* **6**: 44; Common, 1990, *Moths of Australia*: 199, fig. 20.14; Nielsen & Kumata, 1996, *in* Nielsen *et. al.*, *Monogr. Aust. Lepid.* **4**: 49.

Specimens examined. All specimens were reared from leaf-mines on *Typha domingensis* collected at Kan'na-dam, Okinawa-hontô, Ryûkyû, Japan, by S. Tominaga: 3♀, em. 18–19. vii. 2004; 9♂ 15♀, em. 2. xi–9. xii. 2004 (rearing no. 6083 of T. Kumata).

Identification. The specimens from Ryûkyû agree very well with the original description of *Gracilaria* [!] *tricuneatella* given by Meyrick (1880), except for the colouration of the tho-

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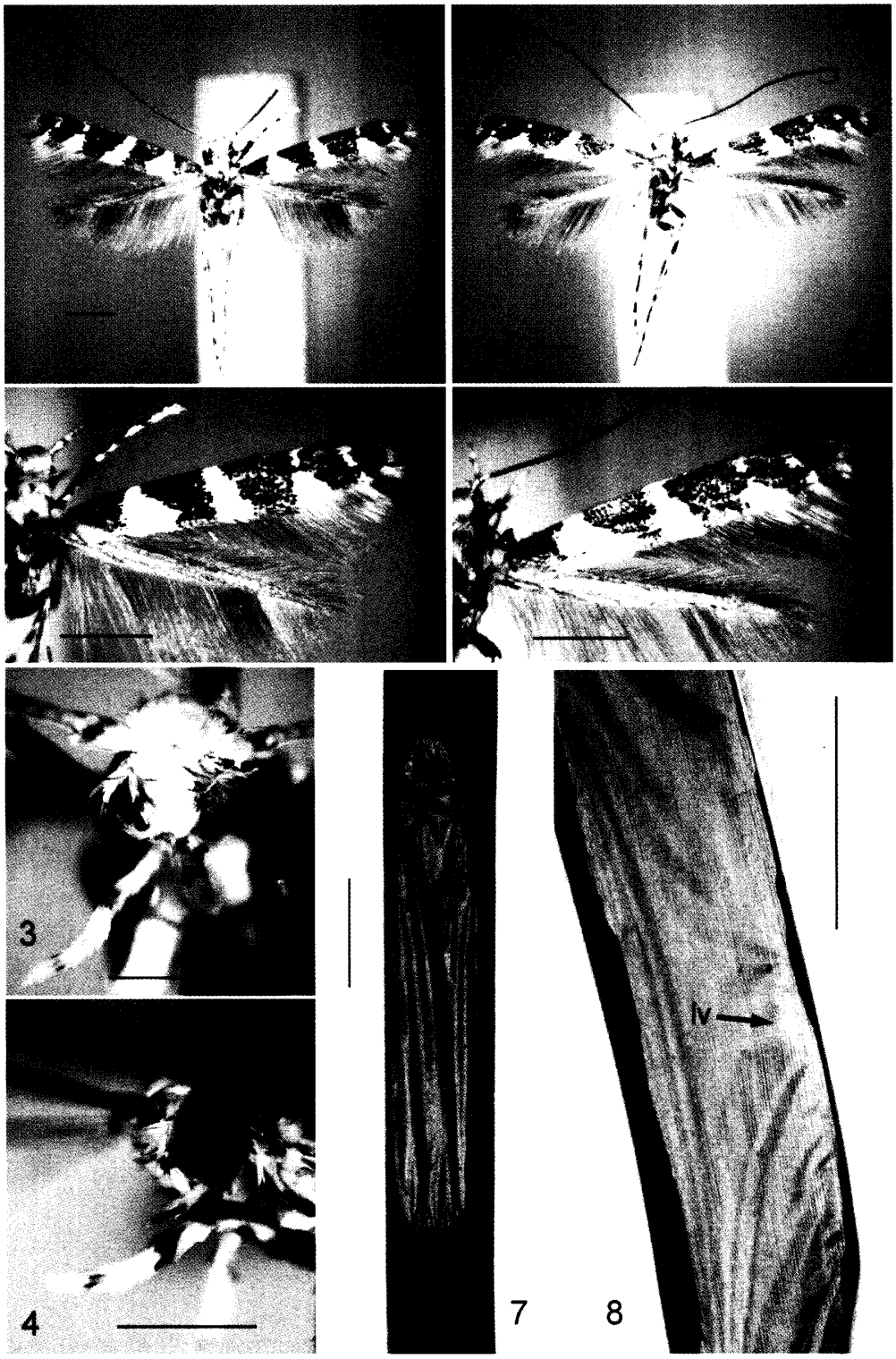

Figs 1–8. *Gibbovalva tricuneatella* from Okinawa-hontô; scale lines 1 mm for 1–6, 1 cm for 7 and 8. 1–4. ♂ (1: moth with abdomen removed for dissection. 2: right forewing. 3: head, frontal view. 4: head, lateral view). 5–6. ♀ (5: moth with abdomen removed for dissection. 6: right forewing). 7–8. Larval mines on *Typha domingensis* (7: whole mine. 8: area around larva (lv) magnified).

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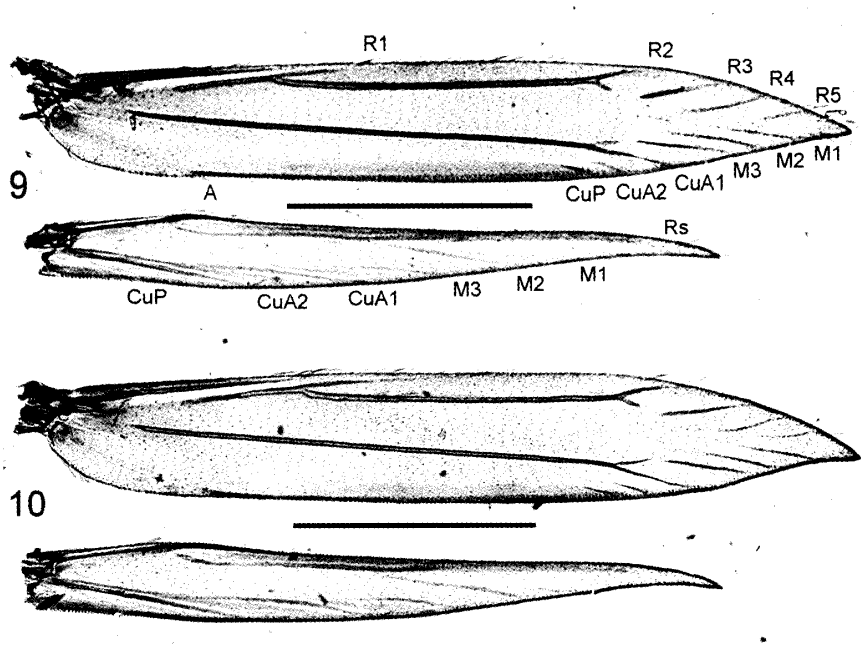

Figs 9–10. *Gibbovalva tricuneatella* from Okinawa-hontô, wing venations; scale lines 1 mm. 9. ♂, slide no. 1850 of KS. 10. ♀, slide no. 1851 of KS.

rax. The thorax is greyish-ochreous in the original description of *Gr. tricuneatella*, though it is whitish in the Ryûkyû specimens. According to the original description, the characters most diagnostic of the species are the greyish-ochreous thorax and three white fasciae on the forewing rapidly dilating towards the fold. Apart from *Gr. tricuneatella*, no gracillariid species have white fasciae similar to those of the Ryûkyû specimens. In addition, the photo of an Australian moth identified as *Acrocercops tricuneatella* (=*Gr. tricuneatella*) by Common (1990: fig. 20.14) is extremely similar to the Ryûkyû specimens including the whitish thorax. On the above-mentioned evidence, the specimens examined are concluded to be referable to *Gr. tricuneatella*. For the generic placement, see the discussion below.

Redescription. Forewing length: ♂ 3.4–3.8 mm; ♀ 3.1–3.9 mm (generally larger than 3.5 mm). No significant differences in colouration between sexes (Figs 1, 5). Colouration and external characters (Figs 1–6) are as in the original description by Meyrick (1880), except for the colouration of thorax. It is white and tinged with brown on the tegula and in the cephalic part (Figs 2, 6). The colouration of the fore and mid legs may be somewhat different from the original description. The black markings are enlarged to such an extent that the legs look blackish, while they were described as whitish in the original description.

Wing venation (Figs 9, 10). Forewing: all 13 veins recognized; R_1 from about 1/3 of wing; bases of R_4, R_5, M_1, and M_2 rather indistinct, but giving the impression that R_4 and R_5 are stalked and that base of M_1 is nearer to the base of R_{4+5} rather than to the base of M_2; CuA_2 basally indistinct; anal vein reaching margin before 1/4 of wing. Hindwing: all veins except for anal vein recognized.

Male genitalia and associated organs (Figs 11–16). Eighth abdominal tergite (Fig. 11) stronger than other abdominal tergites; medial part of cephalic margin modified into a strongly sclerotized apodeme, which is acute apically; a longitudinal ridge extending from apical 1/3 of apodeme to caudal 1/3 of tergite. Tegumen (Fig. 13) elongate spatulate, with a pair of longitudinal rows of setae on ventral surface, and with a pair of long setae at caudal

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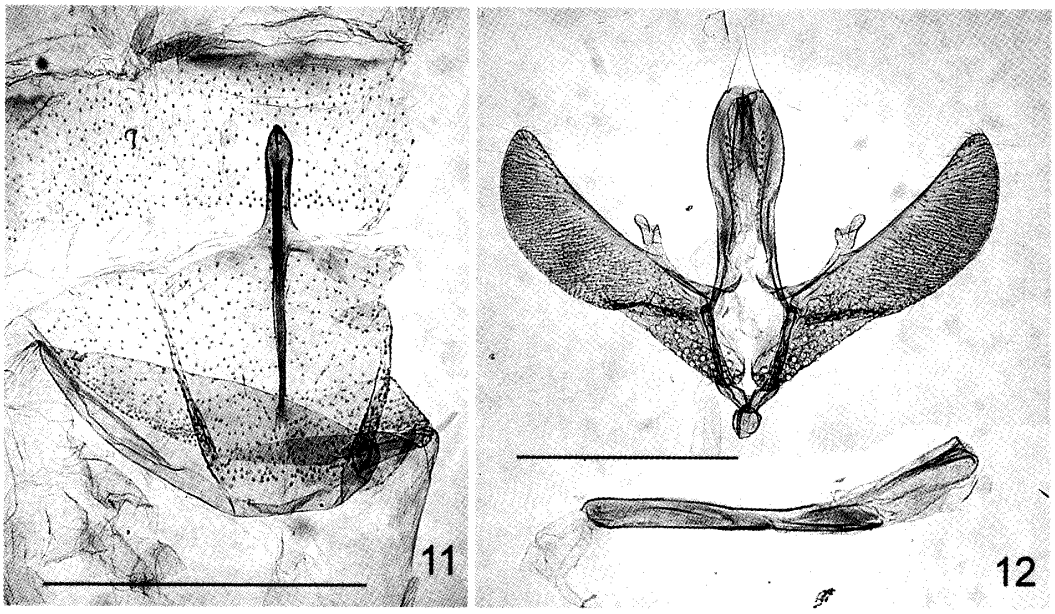

Figs 11–12. *Gibbovalva tricuneatella* from Okinawa-hontô, ♂ abdominal terminal, slide no. 1838 of KS; scale lines 0.5 mm (11: 8th tergite. 12: genitalia).

end; medial part fine-spined near lateral margin. Valva (Fig. 14) approximately four times as long as wide, widest beyond middle, slightly narrowing towards base, abruptly narrowing towards apex because of ventral margin up-curving; an oblique cup-shaped projection arising from beyond 1/4 of harpe just ventrally of strongly sclerotized costa, composed of paired digitate frames and a somewhat sclerotized plate connecting the frames. Vinculum (Fig. 15) with fairly large bowl-shaped saccus, which is concave dorsally. Diaphragma (Fig. 15) modified into moderately sclerotized anellus of flat plate, ornamented with a few setae. Aedeagus (Fig. 12) 4/5 as long as valva, obliquely truncate apically; vesica (Fig. 16) ornamented with numerous fine spines of almost uniform size.

Female genitalia (Figs 17–19). Papilla analis (Fig. 18) fairly short; cephalic part strongly sclerotized, with ventral corner extending as very stout apophysis posterioris. Eighth tergite (Fig. 18) with very large spiracles; cephalic margin strongly concave medially, almost to meet caudal margin; apophysis anterioris as long as apophysis posterioris, thinner than the latter. Ostium (Fig. 18) on membranous eighth sternite. Ductus bursae gradually widening towards corpus bursae (Fig. 17), finely spined in cephalic half, with a colliculum which is slightly shorter than apophysis anterioris. Corpus bursae (Fig. 19) elongate oval, longitudinally folded in caudal 1/4, sparsely spined in caudal 1/3, with a large elongate horseshoe-shaped signum, which occupies caudal 5/6 of the corpus bursae and has several conical projections; conical projections becoming smaller towards ductus bursae.

Foodplant. Typhaceae: *Typha domingensis* Pers. in Okinawa-hontô, Ryûkyû, Japan; *T. latifolia* L. and *T. angustifolia* L. in eastern parts of Australia (Meyrick, 1880; Common, 1990).

Biology (Figs 7, 8). The egg is laid on the upper surface of the food-leaf. The larva of younger instars makes a thin linear mine of a few centimetres long. Later it abruptly broadens the mine into a sub-ellipsoidal blotch of generally 5–7 cm in length and 5–8 mm in width by repeatedly reversing its direction. When the mine has become blotch-like (Fig. 7), the earlier linear part is usually unrecognizable, because it has been 'overwritten' by the ex-

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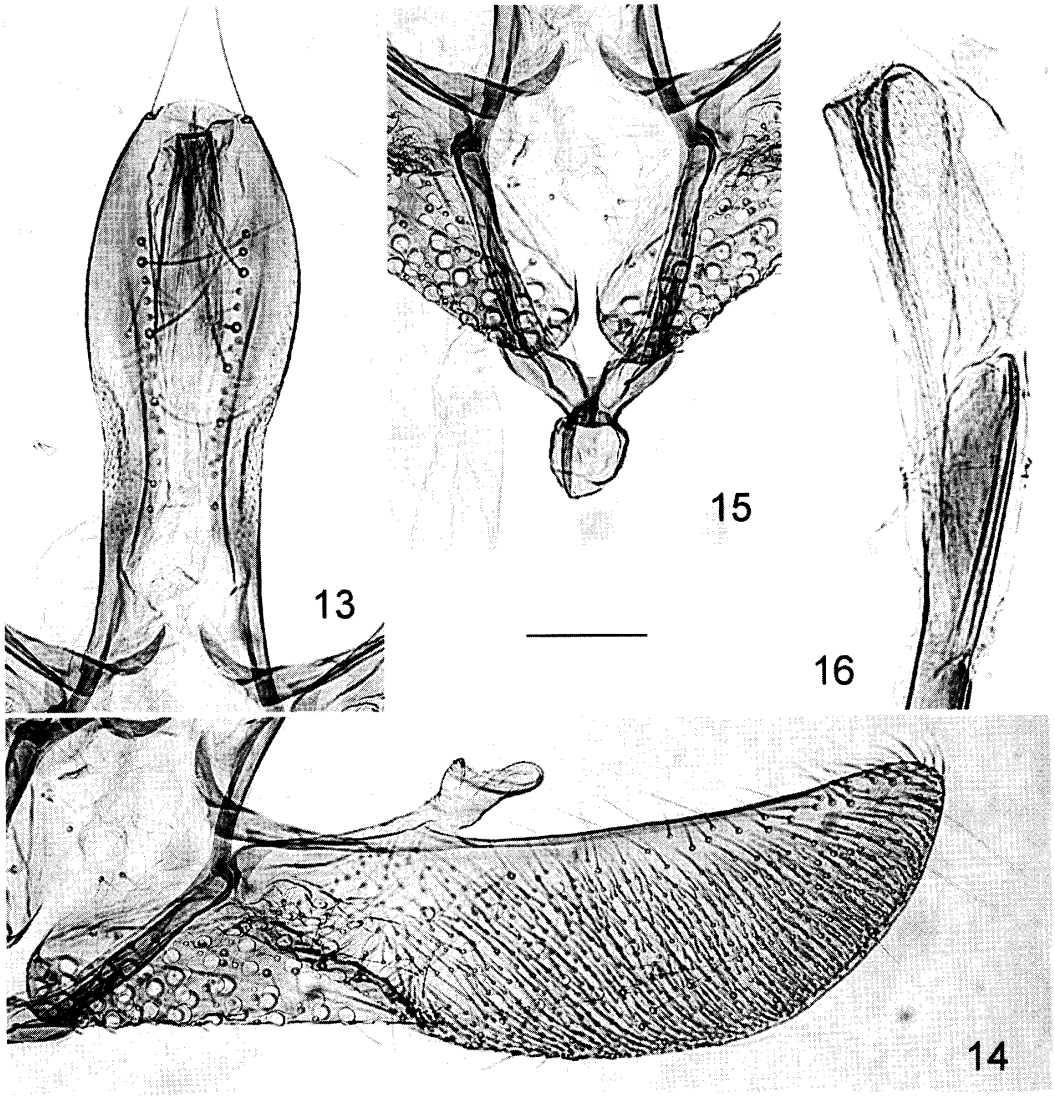

Figs 13–16. *Gibbovalva tricuneatella* from Okinawa-hontô, ♂ genitalia magnified, slide no. 1838 of KS; scale line 0.1 mm (13: tegumen. 14: right valva with androconial hairs, which arose from large sockets, removed. 15: vinculum and diaphragma. 16: apical part of aedeagus and vesica).

panding blotch. The larva apparently feeds exclusively on tissues just under the epidermis of the leaf, and thus the depth of the mine is almost constant without regard to whether the larva is a sap- or tissue-feeding instars. Excrement is retained inside the mine, sparsely deposited along the margin. Mines of a few larvae are often fused to form a very large blotch over 15 cm in length. Larval mines are observed on mature leaves rather than younger ones. Larval body is pale orange (Fig. 8) throughout the larval stage, and does not become reddish even before pupation. Pupation takes place in the mine, in a cocoon surrounded by excrement gathered by the larva.

Three generations were confirmed, each with the larval feeding in February–March, June–July, and November–December; probably one or two more generations are possible in Ryûkyû.

Distribution. Japan: Ryûkyû (Okinawa-hontô). Australia: Queensland, New South Wales

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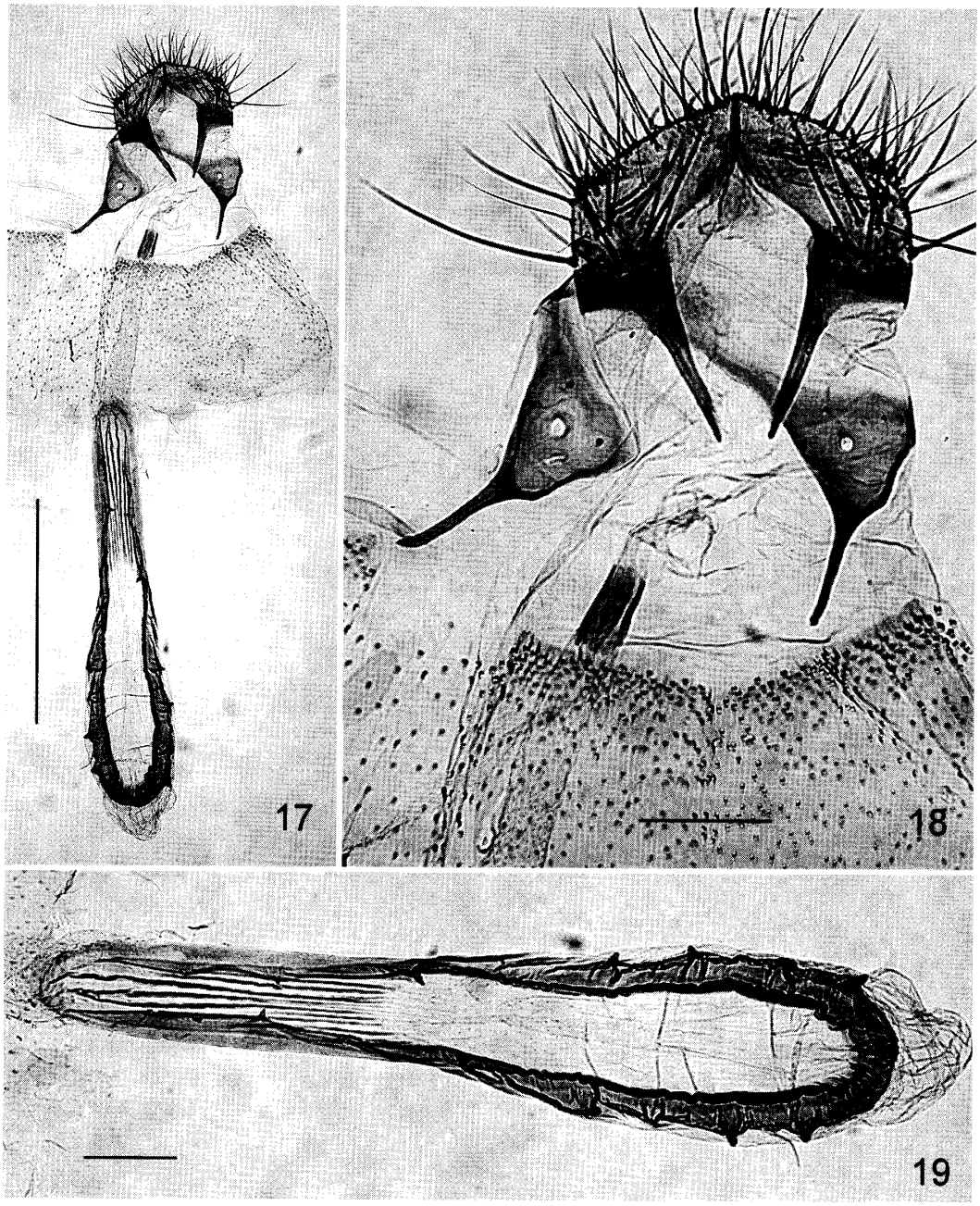

Figs 17–19. *Gibbovalva tricuneatella* from Okinawa-hontô, ♀ genitalia, slide no. 1835 of KS; scale lines 0.5 mm for 17, 0.1 mm for 18 and 19 (17: whole genitalia. 18: caudal part magnified. 19: signum magnified).

(Common, 1990).

Differential remarks. From congeneric species, *Gibbovalva tricuneatella* can be distinguished by the absence of dark-coloured scales in the white fasciae on the forewing. In forewing colouration, some Japanese species of *Spulerina* Vári, 1961 and *Telamoptilia* Kumata & Kuroko, 1988 may be confused with *Gi. tricuneatella*, but those species of other genera have a whitish transverse fascia just near the base of the wing, which is absent in *Gi. tricuneatella*, or lack the transverse fascia on 3/4 of the wing, where a broad fascia appears in *Gi. tricunataella*.

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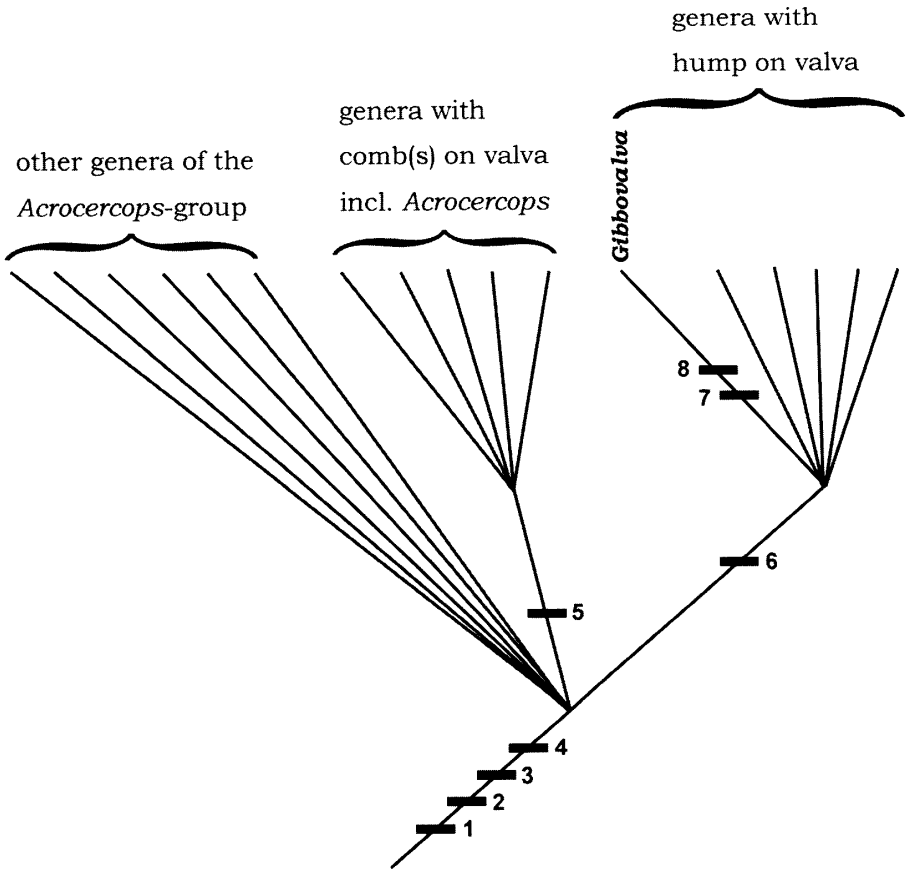

Fig. 20. Putative phylogenetic relationships of genera in *Acrocercops*-group. Putative supporting characters of lineages indicated with rectangles accompanied by numbers, each of which means the followings: 1, hind tibia bristled on dorsal surface; 2, anal veins of forewing reaching hind margin before 1/3 of wing; 3, valva with androconial hairs basally on outer surface; 4, female abdominal eighth tergite with large spiracles; 5, valva with comb(s); 6, valva with hump; 7, diaphragma modified into anellus; 8, antennal scape with scale-flap.

Discussion

Generic placement of *Gracilaria* [!] *tricuneatella*

This species has been classified in *Acrocercops* Wallengren, 1881 (type species: *Tinea brongniardella* Fabricius, 1798), since Meyrick (1912) transferred it to the genus (*e. g.* Common, 1990; Nielsen & Kumata, 1996). Revisions of *Acrocercops* have been attempted several times with transfers of species from *Acrocercops* to other genera (Kumata *et al.*, 1988*a*: 3). Kuznetzov (1979) redefined *Acrocercops* in a narrower sense than it had earlier been. His concept of *Acrocercops* was followed by Kumata *et al.* (1988*a*, *b*), who revised the Japanese fauna of *Acrocercops* and allied genera and proposed some new genera for species formerly placed in *Acrocercops*. Although none of these preceding authors revising *Acrocercops* considered *Ac. tricuneatella*, Common (1990: 199) stated that the species appeared to belong to a more isolated group of species.

According to Kumata *et al.* (1988*a*), four genus-groups are recognized in the subfamily Gracillariinae, *i. e.* the *Parornix*-, *Gracillaria*-, *Parectopa*-, and *Acrocercops*-groups. Although Kumata *et al.* (1988*a*) did not state this, they appear to have delimited the genus-groups mainly on unique derived character states. As to the adult morphology, the

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Acrocercops-group is defined by the hind tibia being bristled on the dorsal surface, by the anal vein of the forewing reaching the margin before 1/3 of the wing, and by the valva of the male genitalia ornamented with androconial hairs on the outer surface basally (Fig. 20: rectangles 1–3). In addition, we found that females of the *Acrocercops*-group share large spiracles on the eighth abdominal tergite (Fig. 20: rectangle 4). These character states are unique to the *Acrocercops*-group within Gracillariinae and are considered to be derived states, which support the monophyly of the group. They are also observed in *Ac. tricuneatella* (Figs 1, 5, 9, 10, 14, 18) and thus the species is certainly referable to the *Acrocercops*-group.

In the *Acrocercops*-group, two conspicuous characters of the valva of the male genitalia are recognized. One is the comb(s), which is (are) one or two rows of stiff scales on the inner surface of the valva, occurring in genera such as *Acrocercops*, *Dialectica* Walsingham, 1897 (type species: *Gracillaria scalariella* Zeller, 1850), and *Artifodina* Kumata, 1985 (type species: *Artifodina japonica* Kumata, 1985) (*e. g.* Kumata *et al.*, 1988*a*: figs 10B, 28A). The other is the hump of the valva, a projection arising from the harpe just below the strongly sclerotized costa, observed in such genera as *Amblyptila* Vári, 1961 (type species: *Amblyptila cynanchi* Vári, 1961), *Sauterina* Kuznetzov, 1979 (type species: *Gracillaria hofmanniella* Schleich, 1867), and *Gibbovalva* Kumata & Kuroko, 1988 (type species: *Gracillaria quadrifasciata* Stainton, 1862) (*e. g.* Kumata *et al.*, 1988*b*: figs 1A, 57B). Some genera of the *Acrocercops*-group have neither the hump nor comb(s), and no gracillariid species have been reported to have both of the two character states. Therefore, these two character states are likely to be independent apomorphies and represent two distinct lineages (Fig. 20: rectangles 5, 6). The valva of *Ac. tricuneatella* (Fig. 14) has the hump but no combs. The implication is that the species belongs not to the lineage comprising *Acrocercops* but to the lineage comprising *Amblyptila* etc. Within the genera of the latter lineage, *Gibbovalva* alone has the scale flap of the antennal scape and the sclerotized diaphragma of the male genitalia (Fig. 20: rectangles 7, 8). These two character states are observed in *Ac. tricuneatella* (Figs 3, 15). We conclude that the species should not be kept in *Acrocercops*, but should be transferred to *Gibbovalva*.

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摘　　要

琉球から発見されたヒメガマを食するホソガ科の一種 (ホソガ科，ホソガ亜科) とその適切な属の所属 (杉島一広・久万田敏夫・冨永智)

沖縄本島からヒメガマ (ガマ科) を寄主植物とするホソガ科の一種が見出された. この種は従来オーストラリア東部に広く分布しガマ (ガマ科) を食することが知られる種と同一であると判断された. この種について生活史を含めて再記載するとともに, 属の所属を変更した.

Gibbovalva tricuneatella (Meyrick, 1880), comb. nov. (Figs 1–19) ガマホソガ (新称)

前翅長 3.1–3.9 mm. 頭部白色. 小顎鬚末端節は黒色. 下唇鬚は白色で, 第2節末端と第3節先端よりやや離れた位置は黒色. 前翅 (Figs 2, 6) は基部後縁沿いが淡色化する他は灰色を帯びた褐色で, 暗色鱗片が混ざらない白色の斑紋, すなわち 1/5, 2/5, 3/4 の白色横帯と 9/10 の向かい合った1対の白点を持つ; 白色横帯は前縁付近では細く, 後方へ向かって幅広くなる; 3/4 の横帯は前縁から少し離れた位置で寸断されることが多い. ♂交尾器 (Figs 12–16) において, valva は背縁付近 1/3 に突出部 hump を備え, vinculum は球状の saccus を持ち, diaphragma は硬化が弱いながらも anellus を形成し, vesica は無数の微小棘群を有する. ♀交尾器 (Figs 17–19) において, signum は corpus bursae 全長の 5/6 を占める長い蹄鉄型のキチン板で, その上に円錐形の突起が並ぶ.

日本産の同属他種からは, 前翅白色部に暗色鱗片が混じらないことで識別される. 日本産のホソガ亜科では, *Spulerina* 属や *Telamoptilia* 属の一部にも本種と混同されうる色彩のものが知られる. しかし, これら別属の種では, 前翅基部からすぐ先に本種に見られない白色横帯が現れるか, あるいは前翅 3/4 の白色横帯を欠いている.

おそらく年多化. 幼虫はヒメガマの葉の上面側表皮直下を摂食し, 初期は線状の, 後に斑状の潜葉痕を形成する. 蛹化は潜孔内に形成された繭内で行われ, 繭は糞粒で囲まれる.

従来この種は *Acrocercops* 属に置かれてきた. しかし, ♂交尾器 valva の harpe が背縁付近に突出部 hump を持つ一方で剛毛列 comb(s) を欠き, diaphragma が硬化することなどの特徴に基づき, *Gibbovalva* 属に移されるべきであると結論された.

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